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Digital Question Papers for Candidates who are blind or have severe sight loss

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Digital Question Papers for Candidates who are blind or have severe sight loss

Report May 2017

Paul Nisbet and Dr Stuart Aitken

First Report April 2014

Second report updated April 2016

Final report updated May 2017



Digital Question Papers for Candidates who are blind or have severe sight loss

Report to SQA, May 2017

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CALL Scotland
The University of Edinburgh
The Moray House School of Education
Paterson's Land, Holyrood Road
Edinburgh
EH8 8AQ
<http://www.callscotland.org.uk>
www.AdaptedDigitalExams.org.uk

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Summary and recommendations

This document reports the results of research into appropriate digital formats for SQA digital question papers, for candidates who are blind or have severe sight loss.

The existing SQA Digital Question Papers are not optimised for candidates who use screen reader facilities and software, and SQA adopts a bespoke procedure for providing digital papers in response to individual requests from schools.

DQPs with Audio in Form Fields

The possibility that a standard procedure to provide accessible digital papers could be introduced was prompted by the development of a new and innovative technique by David Imrie of Ashcraig School in Glasgow. The technique involves adapting PDF files with text that can be read back using the computer (known as 'DQPs with Audio in Form Fields').

Research into this new format has shown that it is very simple to use, for candidates, but lacks flexibility in terms of navigation. It requires significant personalisation and is unlikely to be adopted for common classroom practice, and crucially, does not operate on iPads. Therefore, we do not recommend adoption of this format for digital question papers.

Digital devices used by learners

During the first stage of this research, discussions with staff and students suggested that increasing numbers of learners with visual impairment in Scottish schools were beginning to use iPads, and to explore this further, a survey was carried out to investigate the types of technology and techniques that are employed by learners with visual impairment to access learning materials. Responses were received in respect of 325 learners in 17 local authorities in Scotland.

The responses indicate that while most learners with visual impairment use Windows laptops (205 students out of 325; 63%), a significant number of learners (144; 44%) use iPads instead of or as well as laptops.

In this study, we focussed on learners who are either blind or have severe sight loss and who use screen reading technology, as opposed to partially-sighted learners who are more likely to use screen magnification and/or text reader software to access digital technology. 68 learners out of 325 (21% of the total) were identified as using screen readers. 37 of these learners (54%) use VoiceOver or Speak Selection on the iPad while 32 learners (47%) use a Windows-based computer reader. Therefore, digital assessments aimed at screen reader users must function on **both** iPad and Windows.

Digital File Formats

The most common document file format used by learners with visual impairment who use computer screen readers is Microsoft Word format.

The most accessible file format tested for **both** Question-Only and Question-and-Answer Papers, that is accessible for screen readers on both Windows and iPad devices, is (unprotected) Microsoft Word – provided the author follows established accessibility practice.

However, there may be concerns about the security of assessments in standard Word format because it would be possible for the candidate to delete or modify the questions. Feedback from candidates suggests that this is a low risk, but it is nevertheless a possibility.

HTML 5 (i.e. the web) files with form fields can also be secure and accessible for all devices, for both Question Only and Question-and-Answer Papers, but would require a different approach to design and delivery of the papers.

For Question-and-Answer papers, the only secure and screen reader compatible option for Windows devices is 'Level 2' PDF. None of the formats tested were both secure and accessible on iPad with VoiceOver apart from HTML.

For Question-Only papers, PDFs designed and made fully accessible to UKAAF 'Level' 2 Standards¹ are accessible. The ePub eBook format is an even more accessible option for Question-Only papers, particularly on iPad, because ePub files work well with screen readers and 'reflow' to fit the screen. ePub files are therefore very accessible for the majority of visually impaired candidates who use magnification rather than computer speech, as well as meeting the needs of candidates who use VoiceOver. However, ePub is not suitable for Question-and-Answer papers.

Windows Screen Readers

Format	Question Only Papers	Question and Answer Papers
Level 1 PDF, as currently produced by SQA	Not accessible	Not accessible
Level 2 PDF	Accessible	Accessible but complex
DQP with Audio Form Fields	Accessible	Accessible
Microsoft Word format	Accessible but not secure	Accessible but not secure
'Protected' Microsoft Word	Accessible	Not accessible
ePUB	Accessible	Not accessible
HTML (web)	Accessible	Accessible

¹ UKAAF (2014) Minimum standards: Accessible PDFs for Assessment. <http://www.ukaaf.org/wp-content/uploads/2015/05/MS04-UKAAF-Minimum-standards-Accessible-PDF-for-Assessments.pdf>

iPad VoiceOver

Format	Question Only Papers	Question and Answer Papers
Level 1 PDF, as currently produced by SQA	Not accessible	Not accessible
Level 2 PDF	Accessible	Not accessible
DQP with Audio Form Fields	Not accessible	Not accessible
Microsoft Word format	Accessible but not secure	Accessible but not secure
'Protected' Microsoft Word	Accessible but not secure	Accessible but not secure
ePUB	Accessible	Not accessible
HTML (web)	Accessible	Accessible

We therefore recommend further investigation with trials by learners to develop and test digital papers in Word, 'Level 2' accessible PDF and ePUB formats, to determine the most suitable format(s) for candidates with blindness or significant visual impairment. The feasibility of creating papers in HTML should also be explored.

File format recommendations

	Windows	iPad
Question Only Papers	Microsoft Word Level 2 PDF ePUB HTML	Microsoft Word Level 2 PDF ePUB HTML
Question and Answer Papers	Microsoft Word Level 2 PDF HTML	Microsoft Word HTML

History

The first version of this report was written in April 2014 and submitted to SQA. It described a new type of Digital Question Paper with audio recordings (called “DQP with Audio Form Fields”) that was developed by David Imrie of Ashcraig School in Glasgow. David developed the format for learners with significant visual impairment or blindness. The report recommended trials of DQP with Audio Form Fields and other potential formats that could be accessed by blind candidates using screen reader software.

A series of trials and interviews with a small number of blind candidates was conducted and this report was updated in July 2016 to report on this work and also to reflect the publication of UKAAF (UK Association for Alternative Formats) [Minimum Standards](#)¹ and [Guidelines](#)² for accessible PDFs. These new guidelines describe how examination papers in PDF can be made accessible for candidates who use screen readers.

One of the outcomes of the interviews was an appreciation that learners with visual impairment are increasingly using iPads in school, which are not compatible with DQP with Audio Form Fields. It was therefore important to investigate which devices and technologies were being used by learners in schools in Scotland, for which we designed and distributed a survey to SAVIE (Scottish Association for Visual Impairment Education) in spring 2016. All Scottish teachers of visually impaired learners are members of SAVIE. By September 2016 we had received responses in respect of 325 learners in 17 local authorities.

This final version of the report brings together the results of each stage of the investigation and offers conclusions and recommendations.

² UKAAF (2014) Accessible PDF for examinations: Guidelines.
<http://www.ukaaf.org/wp-content/uploads/2014/09/G019-Accessible-PDF-for-Assessment.pdf>

Background

The current SQA Digital Question papers are accessible for sighted candidates, and can be read out using **Computer Text Reader** software. In most cases, candidates select the text to be read with the mouse, and then use the text reader to read it.

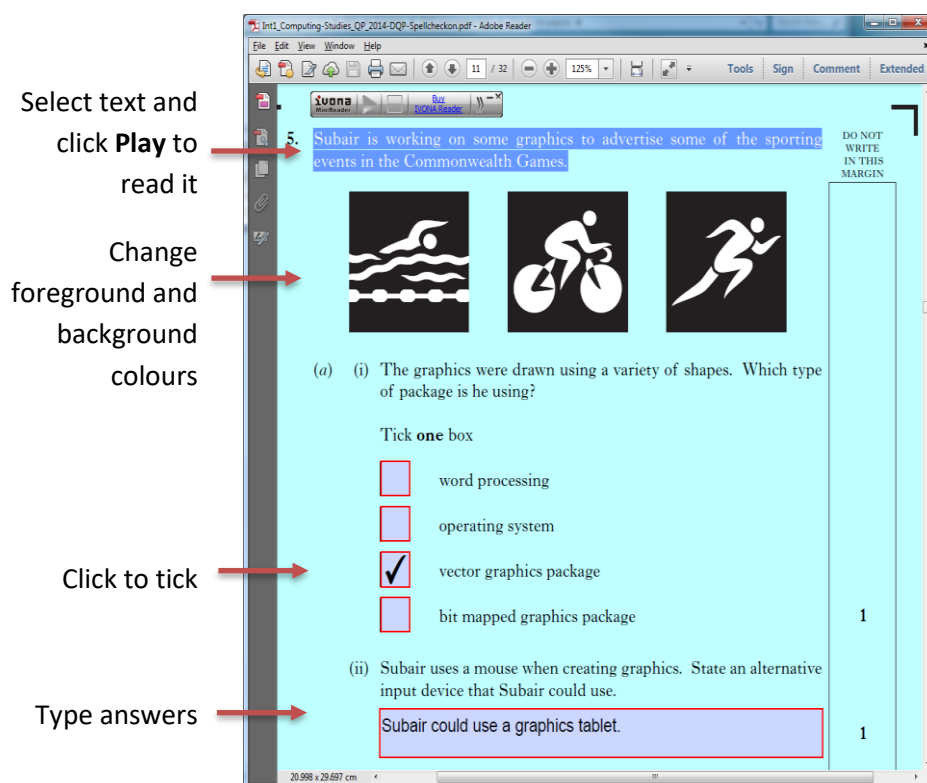


Figure 1: Reading with a Text Reader

However, blind candidates cannot see to select the text, and so require a **Screen Reader**. Screen Readers read out everything on the screen (menus, titles, dialogue boxes, etc.) and, compared to text readers, are more complex and difficult to learn.

There are many screen readers available. Screen Readers are provided as part of Windows, MacOS, iOS, Android and Chromebook operating systems and are available as free and commercial products (RNIB 2017).

Table 1: Screen Reader apps and programs

Software / app	Platform / OS	Cost
Jaws	Windows	From £699
Screen Reader	Windows	From £715
Windows Narrator	Windows	Free, built in
NVDA	Windows	Free
Thunder	Windows	Free
VoiceOver	MacOS	Free, built in
VoiceOver	iOS iPad	Free, built in
TalkBack	Android	Free, built in

The feature set and operation of these tools varies [significantly](#)³, and they are relatively complex to use. They also require the digital file or resource that is being read to be designed with screen readers in mind.

The existing SQA Digital Question Papers are not designed to be used with screen readers and are not accessible for blind candidates who do use them, because:

- reading order is not specified and so items on the page are not read out in the correct order;
- images do not have alternate text descriptions;
- irrelevant elements on the page are read out (e.g. marker's notes);
- tables are not specified as such and so are not read out in a way that can be understood;
- the number of marks for each question is not always clear;
- mathematical and scientific expressions are not read correctly;
- navigation around the paper is difficult because there is no structure; e.g. moving between an English Critical Reading text and the questions that refer to the text is slow and awkward.

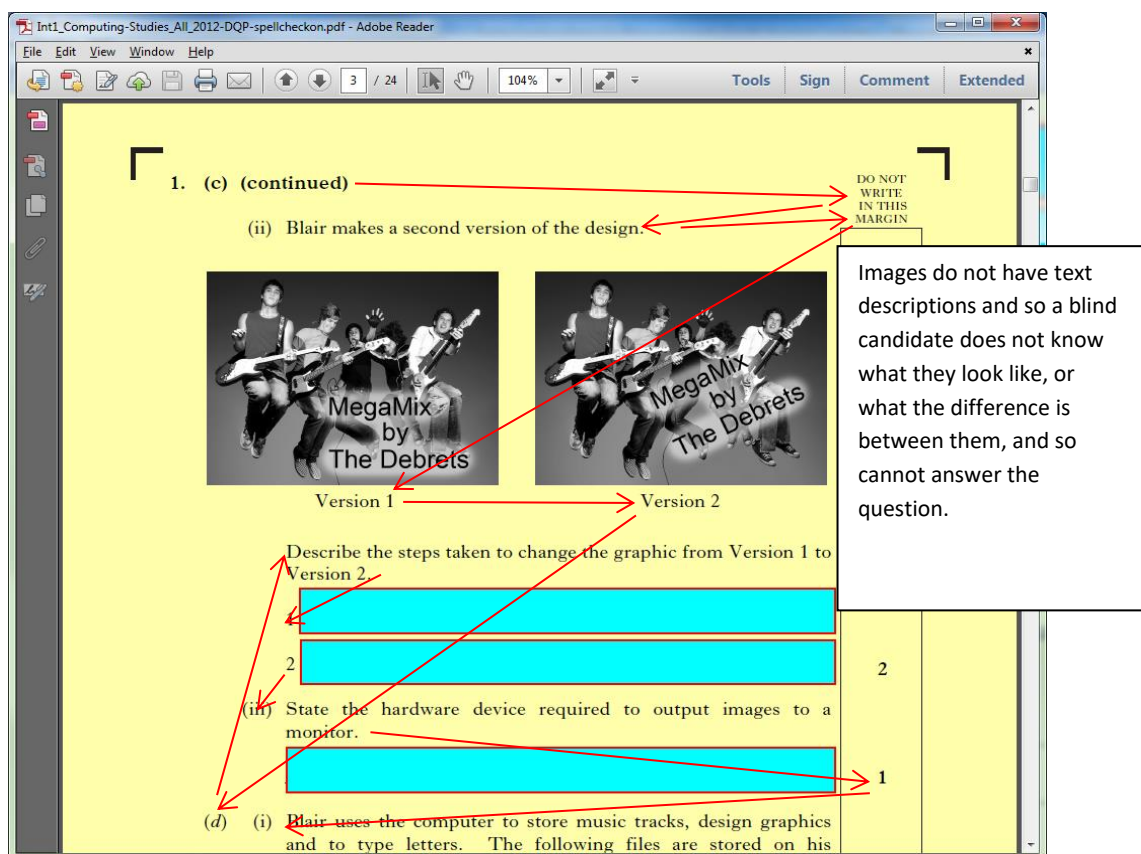


Figure 2: This paper is not accessible to a blind candidate using a screen reader. The text is read out in the order shown by the red arrows (i.e. completely wrongly), and the images are not described.

³ RNIB (2017) Computers and Tablets <http://www.rnib.org.uk/information-everyday-living-using-technology-computers-and-tablets>

In our 2009 report (Nisbet, 2009) we suggested that the best way to address these issues was to:

“...convert or save the text of the paper in another format that can be read successfully using a screen reader, such as DOC, RTF, plain text or HTML and then edit the text in order to produce a suitable file. This is more efficient than trying to make the PDF itself accessible (particularly if the exam paper originated as a DOC or text file before it was composed with Quark Xpress for publishing). This technique is already used by SQA to produce Braille papers. Once the paper is saved as DOC, RTF, Text or HTML:

- the effective reading order can be easily seen and altered;
- suitable indications of navigation features (e.g. ‘page 1 of 8’), marks and other information can be added (e.g. ‘Question 1 (a), worth 1 mark’);
- mathematical and scientific expressions can be typed out (or created with an MathML editor) so that they are spoken correctly;
- text descriptions for diagrams and images can be added.”

Compared to PDF, Microsoft Word has these advantages for users:

- a) most screen reading software such as Jaws and NVDA work well with plain text and Microsoft Word;
- b) learners will generally be skilled at working with Word in class.

However, a potential disadvantage with using Word is that candidates may delete or modify questions. It is not clear whether this is actually a risk in practice (for example, skilled candidates are aware of the possibility of accidentally deleting questions; text markers and instructions can be added to the paper to delineate where answers should be typed; or an invigilator or member of staff could assist the candidate and check that the paper is being completed correctly), but it would be best to avoid this possibility entirely if possible.

When this project began, several possible formats and methods for blind candidates to access Digital Question Papers were identified for consideration:

Format:	Accessed by:
Plain text or Word files	Microsoft Word, with a screen reader such as Windows Narrator, Jaws, Supernova, NVDA or VoiceOver on iPad.
Protected Word forms (with form fields for typing answers and where the questions cannot be edited)	Microsoft Word, with a screen reader such as Windows Narrator, Jaws, Supernova, NVDA or VoiceOver on iPad.
Existing SQA PDF papers	Adobe Reader, with a screen reader such as the built-in Read Out Loud tool, or Windows Narrator, Jaws, Supernova, NVDA or VoiceOver on iPad.
Modified PDF papers, tagged and made accessible for screen readers	Adobe Reader, with a screen reader such as the built-in Read Out Loud tool, or Windows Narrator, Jaws, Supernova, NVDA or VoiceOver on iPad.

David Imrie's DQPs with Audio in Form Fields	Adobe Reader's built-in Read Out Loud tool.
HTML files	Internet browser with a screen reader such as Windows Narrator, Jaws, Supernova, NVDA or VoiceOver on iPad.

The first version of this document reported the results of an investigation into each of these options. A key conclusion from the research was that blind and visually impaired candidates in Scottish schools are adopting iPads, sometimes using the VoiceOver screen reader. This finding prompted further work to investigate which digital formats would be most suitable for learners with visual impairment using these devices.

DQPs with Audio Form Fields

David Imrie at Ashcraig (now Ashton) School in Glasgow has been working with learners with both visual impairment and physical disability for many years and developed a novel approach to providing more accessible digital curriculum and assessment materials. The key characteristics about David's learning resources are:

- They are PDF files: text or questions cannot be edited by the learner; and answers can be typed in to form fields (answer boxes).
- Text-to-speech is provided via the Adobe Read Out Loud screen reader that is part of the Windows version of Adobe Reader, and so there is no need for an extra screen reader program. This may reduce:
 - cost (Jaws Standard costs £699; Supernova Screen Reader is £715; NVDA, Narrator and Thunder are free);
 - the need for specialist software to be installed;
 - and importantly, the operational complexity for the learner.
- Accessing the papers is straightforward for candidates - the learner simply hits the **Tab** key on the keyboard to listen to each question and access the answer boxes because all the information is contained within text form fields. This is much easier than using a screen reader to access a PDF digital paper with form fields (see later).

In this report we refer to these papers as "DQPs with Audio Form Fields" because they are Digital Question Papers where the entirety of the text, questions, instructions and answers are all contained within 'form fields' on the PDF. The candidate can use the built-in Read Out Loud text-to-speech to listen to an audio output of the information.

The papers were first demonstrated to the SAVIE (Scottish Association for Visual Impairment Education) VI Technology group on 27/3/13 and practitioners were invited to contact CALL and David Imrie if they wished copies of papers to trial with candidates. SQA representatives met with David on 25/6/13 and agreed that a scoping exercise should be carried out to investigate likely uptake and approaches to implementation. David continued to develop and refine the format and the papers were again presented and discussed at a meeting of the whole SAVIE

group on 22/11/13, followed by a practical hands-on session at Ashcraig School on 30/1/14. This session was attended by 10 practitioners from:

- Ashcraig School
- CALL Scotland
- Glasgow ASL Technology Service
- East Lothian
- City of Edinburgh
- Angus
- Aberdeen City.

For these introductory sessions with staff, David provided three samples of DQPs with Audio Form Fields:

- Biology Prelim paper on Animal Physiology;
- Intermediate 1 Biology Prelim;
- Extracts from an adapted Intermediate 2 Modern Studies paper.

All three papers were PDF files. The two Biology prelim papers had been created by David originally using Microsoft Word and then converted to PDF, while the Modern Studies paper was adapted from an SQA PDF exam paper.

The basic design of the DQP with Audio Form Fields is that instructions and questions are created as 'form fields' with the text or question typed into the field as a 'Tooltip'. When the user clicks on the form field, or presses the Tab key to move to it, Read Out Loud will read out the Tooltip text. This means that the learner can access the entire content of the paper by pressing the Tab key (Shift-Tab to go backwards), listening and typing.

The method is very simple for the learner compared to accessing a PDF file with a screen reader such as Jaws, Supernova, NVDA or Thunder.

A particularly articulate Ashcraig pupil provided very helpful insights into his use of different types of technology, and the DQPs with Audio Form Fields:

- In class, the learner uses a computer with the built-in Windows screen magnifier (with zoom controlled by the mouse) for reading small amounts of text. (He had previously tried the SuperNova Screen Magnifier but found it "too footery".)
- He uses the free Thunder screen reader for larger passages of text as it is faster and easier than navigating around the screen with the magnifier.
- He uses the Thunder screen reader for reading Word files, which he said works extremely well for him; and Read Out Loud for PDF textbooks and assessments (Thunder cannot read text in PDFs). The textbooks are adapted (tagged and structured) so that the text is in the correct order for reading.

- This access method works very well: he commented that he has never had to use a human reader or scribe in Biology class because he had always used technology and resources prepared by David Imrie.
- When he types answers into the form fields in assessments, he uses Co:Writer to 'echo' back words and sentences so that he can check the answer. (There are many programs that could provide typing speech feedback, but Co:Writer⁴ happens to be available on the computers in school.)
- He prefers the Scottish 'Stuart' voice when using text-to-speech.

Accessing a DQP with Audio Form Fields on Windows devices

To access a DQP with Audio Form Fields, first go to **Edit > Preferences > Reading** and choose a computer voice and set the speed to the candidate's preference. Select the **Read Form Fields** option.

The candidate opens the paper in Adobe Reader and activates Read Out Loud (**View > Read Out Loud > Activate Read Out Loud** or press **Shift + Ctrl + Y**). The method of access is shown below: the learner presses the Tab key to move through each yellow form field. The 'Info'

1. Press the Tab key to move to the first set of instructions, which will be read out automatically.
2. Press the Tab key again: the cursor moves to the 'Name' field and Read Out Loud says "Name of Candidate: Text Field". The learner types a response and presses Tab to move to the next field.
3. Multiple choice questions are answered using the arrow keys or by typing the letter.
4. The learner moves back by pressing Shift-Tab.
5. Long instructions or text passages are broken up into multiple fields so that they are easier to navigate.

Info Information: Ashcraig School: Intermediate 2 Biology. Animal Physiology Prelim exam paper, adapted for candidates with a visual impairment. Core time = 2 hours.

Name:

Date:

Info Information: This paper has 3 sections. Section A awards a maximum of 25 marks. Section B awards a maximum of 65 marks. Section C awards a maximum of 10 marks. There are 100 marks available in total.

Info Information: in SECTION A, all questions should be attempted.

Question 1: Salivary glands produce mucus to: A: lubricate the food in the stomach; B: lubricate the food to aid swallowing; C: protect the mouth from amylase; D: protect the oesophagus from amylase. Answer: ☐

Info Information for Question 2: In the stomach, proteins are broken down into polypeptides. The table below records the concentrations of protein and polypeptides in the stomach over 40 minutes. At 0 minutes, there were 80 grams per litre protein and 20 grams per litre polypeptide. At 10 minutes, there were 73 grams per litre protein and 16 grams per litre polypeptide. At 20 minutes, there were 67 grams per litre protein and 33 grams per litre polypeptide. At 30 minutes, there were 60 grams per litre protein and 40 grams per litre polypeptide. At 40 minutes, there were 50 grams per litre protein and 50 grams per litre polypeptide.

Info Question 2: What was the ratio of protein concentration to polypeptide concentration after 30 minutes? A: 3 to 2; B: 2 to 3; C: 2 to 1; D: 1 to 2. Answer: ☐

Info ☐

Figure 3: Question and Answer Multiple Choice PDF Paper with Audio Form Fields

⁴ Co:Writer. <http://donjohnston.com/cowriter/>

fields have instructions that correspond to the text, while the form fields with red borders have questions and enable the learner to type an answer. The Info fields are locked so that the learner cannot type into them. Likewise, the 'tool tips' with the questions cannot be altered by the learner and so the questions are secure.

There are some disadvantages of the method compared to using a general purpose screen reader to read a PDF:

- The learner cannot navigate within the text of a form field, or control the speech when it is reading – it can be stopped by pressing the Tab key to move to the next field, and then pressing Shift-Tab to go back and read again from the beginning. This means that long passages of text (for example, for assessments of comprehension) must be split into a series of short navigable form fields.
- Similarly, the learner cannot easily navigate within the answer box to edit an answer because Read Out Loud cannot read individual words or letters – it can only read the entire answer. The Ashcraig pupil advised deleting the whole answer and re-typing. The papers are therefore most suited to questions that require relatively short typed answers.
- When arrow keys are used in the multiple choices drop down 'combo box' questions (see above), the answer is spoken after the key is pressed, by which time the previous and next option (i.e. the wrong one) has been selected in the list. Learners could however be taught how to choose the correct response.
- The learner cannot navigate quickly to a particular page or question – each question must be stepped through sequentially. Whereas with a properly tagged PDF and a screen reader, a learner could navigate easily to a question.

However, the simplicity of the method, for many users, may outweigh these issues for simple question-and-answer papers because reading and accessing PDFs with answer boxes using a separate screen reader is so much more complex. Note that learners will still need to learn how to use a general purpose screen reader to access the Internet, Word files, eBooks etc. and other digital resources.

Creating a DQP with Audio Form Fields

There are two methods for creating DQPs with Audio Form Fields. Existing SQA PDF papers can be adapted with audio form fields, or papers can be created from scratch using Microsoft Word or Adobe InDesign, then converted to PDF and the audio form fields added. Both have advantages and disadvantages and the notes below are given for general information, not as detailed guidance on how to create papers.

Figure 4 demonstrates the basic technique for adding text information fields to a PDF paper using Acrobat Pro. In this example created by David Imrie, each separate paragraph has a corresponding form field so that the learner can tab through and listen to each in the correct order. The tooltip can be seen by pointing at the field with the mouse.

Read Out Loud automatically reads out the Tooltip in each field, and so the tooltip for the first paragraph consists of the following text:

“Paragraph 1, lines 1 to 3: Tennis players are a funny bunch. Have you noticed how they always ask for three balls instead of two; how they bounce the ball the same number of times before serving, as if any deviation from their routine might bring the world collapsing on their heads?”

To insert the text into the tooltip, it can be typed or copied and pasted from the PDF itself. It may be quicker to export the text of the paper as Plain Text or a Word file, and copy and paste from that.

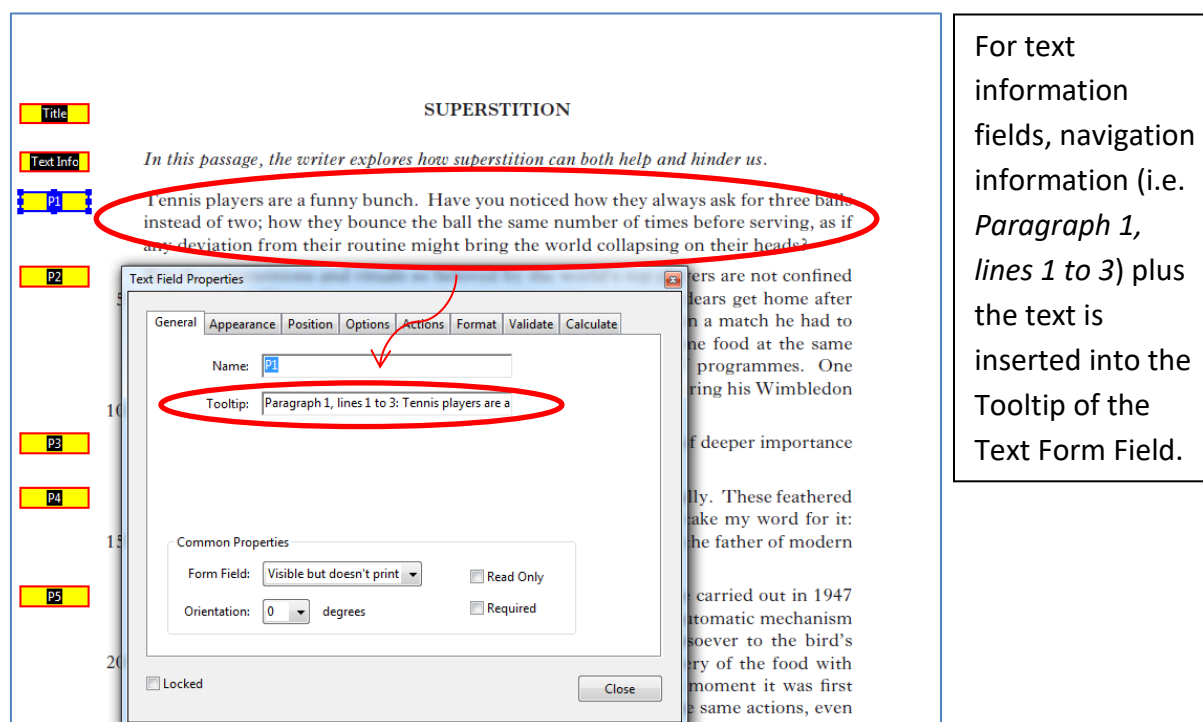


Figure 4: Text Information in an English Close Reading DQP with Audio Form Fields

When we come to creating fields for the questions, the tooltip usually gives the:

- question number (e.g. *Question 1*);
- number of marks (e.g. *For one mark*);
- and the question itself (e.g. *Listen to lines 1 to 3, and then explain in your own words what is meant by tennis players being a funny bunch.*)

The learner listens, and types the answer in directly.

The form fields and layout can be adapted to suit the type of assessment and to make the paper more accessible for the learner. In Figure 5, for an English Close Reading paper, David has separated the question and answer boxes and added a third field with text from the passage:

- the first field gives the question as above;

- the second field speaks the text from paragraph 1, lines 1 to 3;
- and the third is the actual answer box.

The advantage of this design is that the candidate does not have to navigate all the way back to the text: he or she can listen to the question, then the passage, and then type the answer.

Although this might seem to provide the candidate with an advantage, we suggest that this is a reasonable adjustment because of the difficulties that a blind candidate would face when responding to this question when using a standard PDF that has not been adapted in this way. A sighted candidate can quickly flip the page over, or scroll up to find the relevant passage of text; a blind candidate would have to Shift-Tab back through each field to find the correct passage, listen to it, remember the content, and tab back to the answer box. Co-locating the question, text and answer fields enables the candidate to access the assessment in a much more efficient and fairer manner.

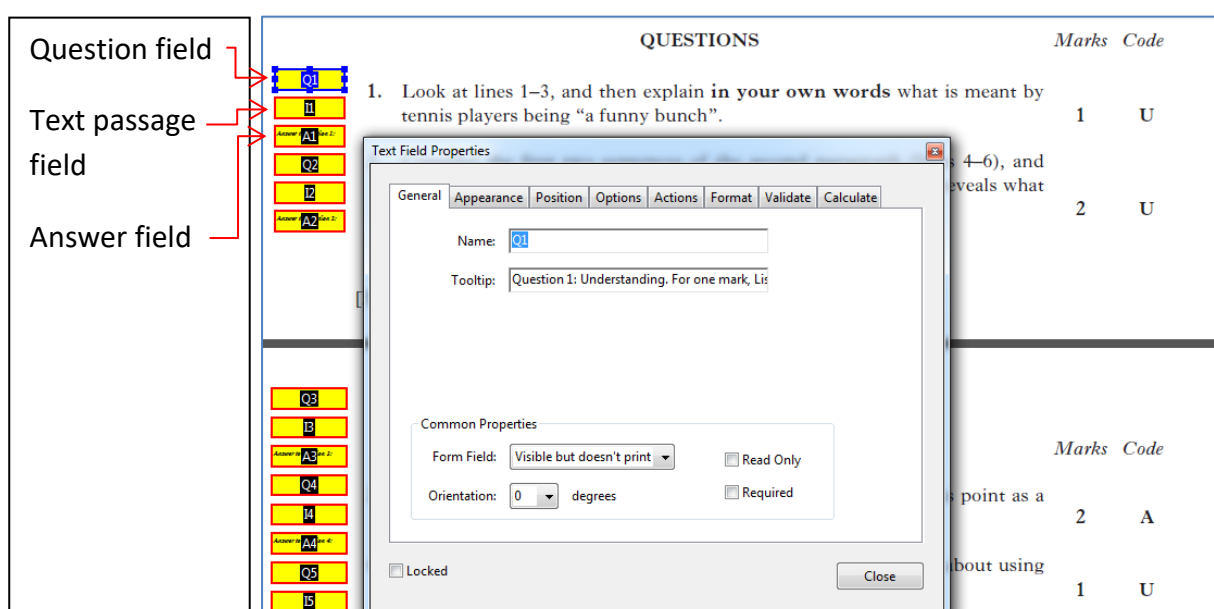


Figure 5: Question and Answer Fields in an English Close Reading DQP with Audio Form Fields

The original version of this assessment is provided as a Question paper with text and questions, and a separate Answer Book. While candidates can use digital versions of the question paper and answer booklet, it is a challenge for a blind candidate, who must:

- swap from the question paper to the answer booklet;
- check that the cursor is in the correct place;
- type the question number and then the answer, and swap back to the question paper.

Expert screen reader users may be able to undertake this, but there is a risk that errors will occur in a high-stakes examination.

Consequently, for this paper, David has firstly appended pages from a Digital Answer Booklet to the end of the question paper, and then copied each answer box to a blank page. When the candidate types an answer next to the question, it is automatically copied to the answer page for printing out at the end of the paper. This again improves efficiency and independence for blind candidates.

QUESTIONS	
<div><div></div><div></div><div>Answer to question 1</div></div> <p>1. Look at lines 1–3, and then explain in your own words what is meant by tennis players being “a funny bunch”.</p>	
<p>Please remember to insert the number of the question being answered.</p> <div><p>Answer to question 1:</p><p>They are a funny bunch because they have superstitious habits.</p></div>	<p>Candidates must not write in this margin</p>

Figure 6: The answer typed in to the answer box on page 3 is automatically copied to the answer booklet pages at the end of the paper, ready to be printed out

David has found that it is more efficient to save the text from the PDF as a text or Word file, edit and adapt the Word file and then convert back into PDF rather than adding form fields to the original PDF. By designing the resource with Word tables, Acrobat Pro can automatically create the answer boxes with tooltips, which saves time manually drawing them in (Figure 7).

Investigation title:

Experiment Plan

Name:	Class:	Date:
-------	--------	-------

Problem
 I am trying to find out ...

I could change ...	I could measure or observe ...
--------------------	--------------------------------

I will change ... <small>(this is the independent variable)</small>	I will measure or observe ... <small>(this is the dependent variable)</small>
--	--

Fair Test
 To make my test fair, I will keep these variables the same ...

Prediction
 What I think will happen is ...

I think this will happen because ...
(try to use scientific ideas)

Figure 7: An Experiment Plan created with Word tables and then converted to a PDF with Audio Form Fields

The disadvantage of this method is that the end result does not visually match the original paper. But since it is to be used by candidates with no or very little sight, this is not an issue.

Initial feedback from users on DQP with Audio Form Fields

David Imrie developed and refined the Audio Form Field method with a small number of pupils in Ashcraig School and it is clear that these learners find the resources of great benefit. The next step was to introduce them to other schools and learners, but the level of interest from the Visual Impairment specialists of SAVIE was relatively low, and only four local authority services were represented on the training day on 29/1/14.

Participants took sample papers away to work with learners, and feedback was received from one specialist working with one pupil in Aberdeen.

The pupil was “very positive and she became more enthusiastic with familiarity” although she “does not currently make a lot of use of audio for learning and found it harder initially to just listen to the information”. She noted that “you need a good auditory memory”. The pupil “did not like the American voice and was not able to understand all the words” which suggests that one of the free Scottish voices should be installed and selected instead. She “liked being able to listen to what she had typed in” and in the English Close Reading passage described, she “liked having the text fields for the questions linking to the passage”.

In April 2014, we suggested that this single response together with the evidence from Ashcraig did not provide sufficient justification on which to introduce the format and that more trials were required to investigate whether DQPs with Audio Form Fields were appropriate and viable assessment arrangements for candidates.

Conclusions regarding DQP with Audio Form Fields

The teacher’s comment that the learner did not make use of audio for learning points to a wider issue. In the meetings and discussions with SAVIE members, it was not clear how many learners with blindness or severe visual impairment actually use screen readers or text-to-speech to access curriculum materials, and some teachers did not seem to be aware of the free tools such as NVDA and Thunder at all. If specialist VI staff are not aware or do not have expertise to use screen readers, it is unlikely that learners will be taught how to use the software.

The DQP with Audio Form Fields format is new and innovative, and entirely unfamiliar to learners and staff. While there could be a *latent* demand for question papers in this format, it is unlikely that this would be manifested as an *actual* demand, unless staff and pupils gain experience of using the format in class. Provision of past papers in the format is unlikely to provide the necessary experience: learners would require assessment and curriculum materials in the DQP with Audio Form Fields format to develop both technical expertise and satisfactory auditory memory skills. Furthermore, one of the principles governing the use of SQA Assessment Arrangements is that “Assessment arrangements should reflect, as far as possible, the candidate’s normal way of learning and producing work” (SQA, 2016).

It would not be necessary to provide *all* curriculum materials in the DQP Audio Form Field format (the Ashcraig pupil reads some resources with Word and the Thunder screen reader),

but blind and partially sighted learners will need tuition and practice both with text-to-speech and screen readers in general, and with DQPs with Audio Form Fields in particular, before they are sufficiently proficient to use and therefore request DQPs with Audio Form Fields.

Assessment Arrangements reflect classroom practice, and so introducing DQP with Audio Form Fields would require a development programme to:

- raise awareness of the DQP with Audio Form Fields format;
- teach staff how to create curriculum resources;
- ensure that learners have the required software;
- develop guidance materials for staff and pupils;
- teach learners how to use materials.

At the meeting in Ashcraig in January 2014, the group felt that a first step would be to produce a simple English comprehension activity that teachers and pupils could use to explore the new format and develop their skills. The sample papers and materials created by David are subject and level specific and so are not suitable for a widely applicable introduction to DQPs with Audio Form Fields. Staff from the Glasgow ASL Technology Service therefore adapted a suitable English comprehension exercise and this was converted into the DQP with Audio Form Fields format. The exercise is given in Appendix 1.

Secondly, CALL asked members of SAVIE to identify learners in secondary school with blindness or severe visual impairment who might benefit from using screen readers and the DQP with Audio Form Fields format. The intention was to provide this sample activity together with support and guidance notes, and obtain feedback.

During these interviews, we asked learners for their views on the sample exercise in three different formats:

- DQP with Audio Form Fields
- Microsoft Word (accessed using a screen reader)
- PDF (accessed using a screen reader)

The results are reported later.

DQP with Audio Form Fields on iPad

The papers were tested on a range of iPad apps (iBooks, PDF Expert, ClaroPDF, Adobe Reader and Voice Dream Reader) and the text contained within the information fields was not read out by any of the apps. Therefore, the format is not suitable for use on iPads.

Papers in Microsoft Word format

As mentioned previously, one technique to create a digital paper for a candidate using a screen reader is to go through a similar process to that already used to create a Braille paper. The paper is modified for example to remove irrelevant information, add the marks for each question and text descriptions for images, ensure that tables and other elements are properly accessible and can be read and understood, etc. Some [Braille past papers](#) are available in PDF and Braille (Duxbury format) from SQA. Detailed guidance on modifying papers for Braille is available from RNIB (RNIB 2014).

This would produce a paper that is suited for candidates with no or very little sight. The file would then be made accessible to create a Microsoft Word DOC/DOCX file. Guidance on creating accessible Word files is available from WebAIM and RNIB.

In the example below (Figure 8), a test file with text and tick boxes was created by saving plain text from an SQA Intermediate 1 Computing paper (2012). The file was opened in Word and the following modifications were made:

- irrelevant text was removed;
- questions were numbered using Word automatic numbering (e.g. Question 1 (a) i);
- marks for questions were inserted (e.g. '1 Mark');
- text descriptions of image were inserted;
- tables were created.

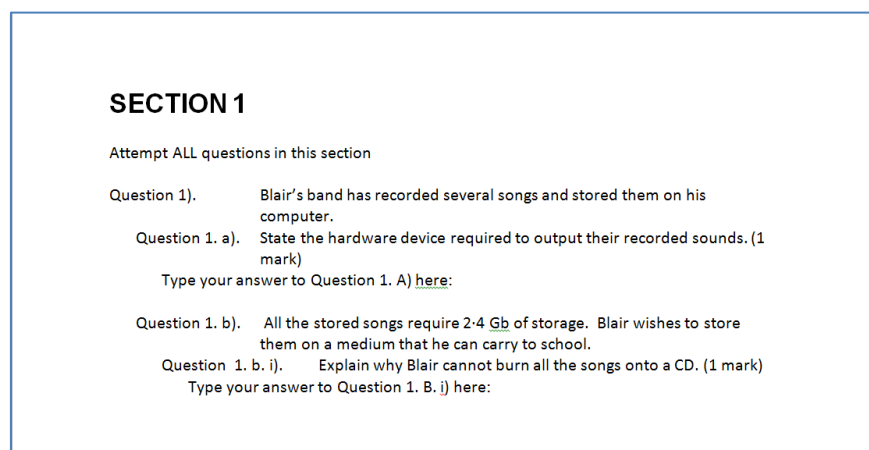


Figure 8: Accessing a standard Word file with a screen reader

Microsoft Word files on PC with screen readers

A candidate would use a screen reader to access each question and type the answers where indicated in the blank lines. The advantages of this method are:

- it can be used for many curriculum materials that teachers provide as Word files;
- the candidate can navigate around the paper (provided it has structure and heading styles);
- the candidate can use Word tools such as Find, Replace, the spellchecker etc.;

- staff and learners are generally familiar with Word;
- screen readers generally work well with Word.

Microsoft Word files on iPad with VoiceOver

Simple linear Word files can be accessed efficiently on an iPad with VoiceOver.

Security

However, since it is possible for the candidate to accidentally delete the question text, a more secure method was investigated.

Microsoft Word (protected with form fields)

The same file was then adapted using Microsoft Word text with tick box 'form fields'.

The file was "protected" and then tested using NVDA, a free screen reader. The first task – restricting alterations to the questions – was achieved, but typing answers into the fields was complex. Reading questions requires the use of 'Browse Mode', whereas typing answer requires the program to be in 'Focus Mode'. It proved extremely challenging to synchronise the position of the virtual Browse Mode cursor (which is used to read the question) with the actual text caret (for typing answers) with the result that it was very easy to read out one question, but type the answer into the field for a different question. Research on the internet and on the NVDA support materials did not shed light on whether it is in fact possible to use NVDA in this way to access protected Word files with form fields.

Guidance notes from Freedom Scientific⁵ (the creators of Jaws) suggests that using screen readers with protected Word files is generally problematic, and so routine use of this format does not, currently, seem suitable for Digital Question papers for blind candidates.

On an iPad, the test files in protected Word format could be read and answers entered but the questions could be edited, so the file was not secure.





<p>SECTION 1</p> <p>Attempt ALL questions in this section</p> <p>1. Blair's band has recorded several songs and stored them on his computer. </p> <p>a. State the hardware device required to output their recorded sounds. (1 mark)  Click here to enter text.</p> <p>b. All the stored songs require 2.4 Gb of storage. Blair wishes to store them on a medium that he can carry to school.</p> <p>i. Explain why Blair cannot burn all the songs onto a CD. (1 mark) Click here to enter text. </p> <p>ii. State a solution to this problem. (1 mark) Click here to enter text. </p>	<p>Questions are protected and cannot be altered.</p> <p>Answers are typed into editable text fields.</p>
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Figure 9: Microsoft Word paper, protected with form fields

⁵ <http://www.freedomscientific.com/Training/accessible-forms-in-word.htm>

‘Level 1’ SQA PDF Digital Question Papers

The existing PDF Digital Question Papers produced by SQA can be read using a screen reader, but they are not adequately accessible because: they are not tagged; the order in which the text is read out is often wrong; irrelevant text is read out; images do not have text descriptions; and information in tables in most cases cannot be understood. They are therefore not accessible for these candidates. These papers are classed as Level 1 PDFs under the UKAAF guidelines.

Standard SQA Paper with Windows Screen Readers

By way of example, Figure 10 shows the order in which the text on the page is read out, for the 2012 Intermediate Computing paper. This makes no sense to the candidate. In addition, the images in this paper do not have alternative text descriptions and so the candidate cannot answer the question.

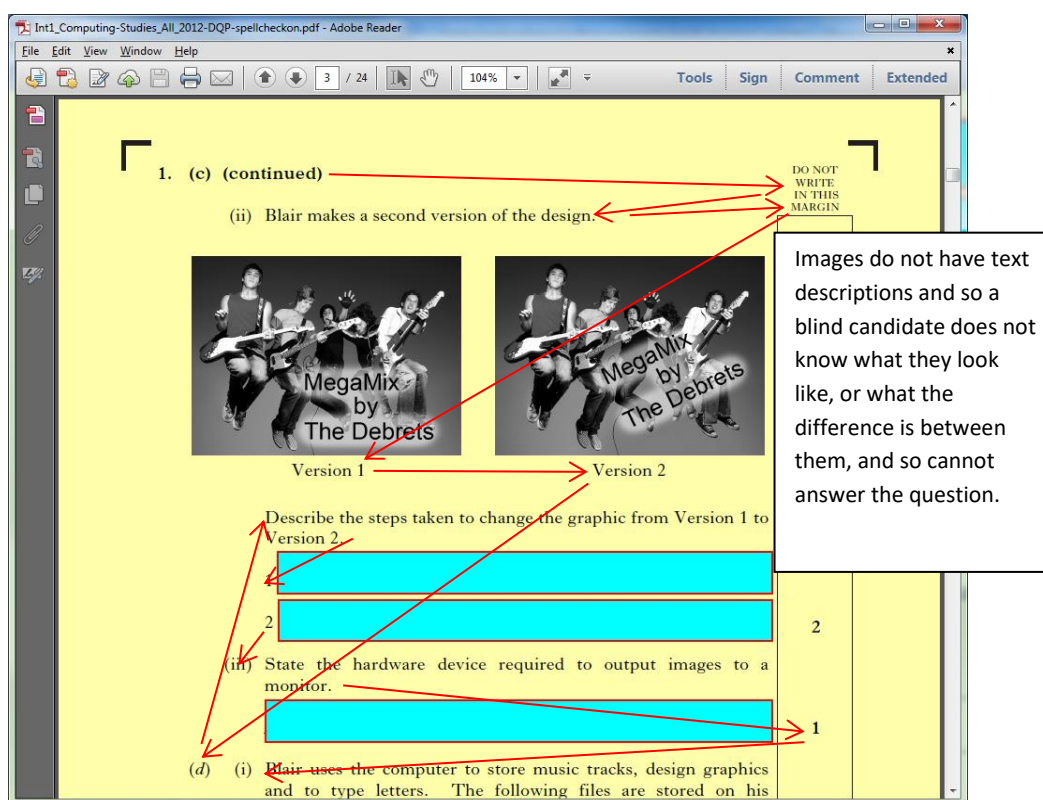


Figure 10: Reading order in a standard SQA paper is inaccessible

While it is possible to use a screen reader to read the paper and then enter text into answer boxes, it is not practical or feasible because of the issues with reading order and because of the other inaccessible elements.

Standard SQA Paper with iPad and VoiceOver

The same issues described above occur on iPads with VoiceOver. VoiceOver did not identify answer boxes and so candidates would not be able to tell where and when to start typing answers.

‘Level 2’ Accessible PDF Question Papers

One option is to improve the original paper’s accessibility by using tools and features in Acrobat Pro (Adobe, 2014) to:

- set the reading order;
- add text descriptions to images;
- set irrelevant text items to be ignored;
- define tables as tables so that text is read in the correct order.

Detailed guidance on creating accessible PDFs is provided by Adobe⁶ and the recent guidance from UKAAF (UK Association for Accessible Formats²) to JCQ recommends that PDF examination papers designed for candidates with sight loss are properly tagged and made accessible.

While this process can be undertaken using Acrobat Pro on a finished PDF, it is this author’s view that in most cases this will not result in a paper that is properly accessible to a blind candidate using a screen reader. While it is possible to ‘touch up’ the reading order, define page elements that should or should not be read, and add text descriptions for images, it is almost always necessary to modify the actual text of the assessment in order to make it accessible.

Rather than modifying a PDF that is inherently difficult or impossible to edit, a better method of production is to save the text from the original InDesign file, or from the PDF, and then modify the paper itself with InDesign or a word processor/text editor to ensure that it can be read and understood by a blind candidate. The process required is similar to that already used when creating Braille versions of papers and as noted earlier, guidance on modifying papers is available from RNIB.

The modified paper is then saved as a PDF file, and answer boxes inserted in the usual way. An example of this method is given overleaf.

Figure 11 shows the Word version of the paper discussed in the section on

⁶ Adobe Acrobat Accessibility <http://www.adobe.com/accessibility/products/acrobat.html>

Papers in Microsoft Word earlier, converted to PDF, with answer boxes added, and with the reading order adjusted.

The NVDA screen reader can be used to step through each section of the text, and answers can be typed into the answer boxes.

The advantages of this method, compared to the DQPs with Audio Form Fields, are that candidates can navigate around the entire text of the paper, and also read and edit their typed answers. However, accessing the paper is considerably more complex for the candidate, who must learn to use NVDA or another screen reader, memorise keyboard shortcuts to move around the PDF and toggle between 'Browse Mode' to read the questions and 'Edit Mode' to type answers. In addition, synchronising the 'Browse Mode' focus with the text caret so that the answer that is typed corresponds to the question being read requires close attention from the user.

SECTION 1

Attempt ALL questions in this section

Question 1). Blair's band has recorded several songs and stored them on his computer.

Question 1. a). State the hardware device required to output their recorded sounds. (1 mark)

a sound card

Question 1. b). All the stored songs require 2.4 Gb of storage. Blair wishes to store them on a medium that he can carry to school.

Question 1. b. i). Explain why Blair cannot burn all the songs onto a CD. (1 mark)

the CD does not have enough capacity

Question 1. b. ii). State a solution to this problem. (1 mark)

Figure 11: Modified, accessible PDF paper created from a Word file

Accessible Level 2 SQA PDF paper on iPad with VoiceOver

A Level 2 paper is read out correctly with VoiceOver, but answer boxes are still not identified, and so this is not a solution for question and answer papers on iPads.

Feedback from interviews with users

The CALL team asked members of SAVIE to identify learners in secondary school with blindness or severe visual impairment who might benefit from using screen readers and the DQP with Audio Form Fields format.

CALL staff created a sample comprehension exercise

Appendix 1: Sample Comprehension Exercise used for interviews with learners) and visited the learners to introduce the DQP with Audio Form Fields, and to compare it with two other formats: plain Microsoft Word, and a Level 2 PDF file without audio form fields.

However, it was quickly apparent that the learners and staff were also interested in exploring the possibility of iPads with the built-in VoiceOver screen reader, and so this was discussed although not tested during the interviews.

Learner 1	L is in her early twenties and is an expert user of Jaws on Windows, and VoiceOver on iPhone. We sought her advice first because of her experience and technical skills. L tested versions of an Intermediate 1 Computing Studies that we had created in Word, standard PDF and PDF with Audio Form Fields.
Date of interview	15/4/14
Word format	L felt that Word was a good option because Jaws works well with it. She did not think that the risk of candidates inadvertently or deliberately deleting text in the question paper was significant because Jaws users are so used to accessing learning materials in that format.
Level 2 PDF format	L thought that the PDF format was accessible.
PDF with Audio Form Fields format	L felt that the format was simple but did not give sufficient flexibility to navigate around the questions, or to read and edit answers.
iOS	L thought that it was important to offer papers that would function on iOS.

Learner 2	A, P7. A uses Jaws 11 on a Windows laptop. He also has a BrailleNote (a laptop with a Braille display and keyboard), and an iPad.
Date of interview	13/6/14
Word format	A is not as expert with Jaws as L, and found that it was too easy to delete text or questions in the Word file.
Level 2 PDF format	This worked well. A found it easy to swap in and out of the answer box to read the text and question and then type answers: in this respect, Jaws seems easier to use than the free NVDA screen reader. A had more flexibility to read and navigate the text that he had typed into the answer box using Jaws (unlike the PDF with Audio Form Fields format, which does not offer this type of control).
PDF with Audio Form Fields format	A clearly found this format straightforward to use. He slowed the speech rate down to 170 wpm. One limitation (identified earlier) is that there is no key echo while the text is being typed, and so A could not check the accuracy of his typing as he was typing. Therefore, another program is required to provide this function. A did not express a preference for this format compared to the others.

Learner 3	E, S1. Beginning to use an iPad with VoiceOver. Previously used a BrailleNote but no longer does because of technical problems impacting on its reliability. She has some experience with JAWS.
Date of interview	2/12/14
Word format	OK. Her preferred method of working on a computer.
Level 2 PDF format	OK.
PDF with Audio Form Fields format	OK, easy, liked it, but inflexible and not the best for moving around the documents.
iOS	E says this would be her preferred option. She has not learned yet how to use it for writing, though and has not tried VoiceOver with Word or Pages.

Learner 4	C, S3. C's vision recently deteriorated and she has just started using an iPad with ClaroSpeak. The school has a laptop with Jaws and Supernova, and teaching C Braille is another option. C has arthritis and so cannot type for long periods.
Date of interview	20/1/15
Word format	Not suitable - she doesn't use Jaws and is not familiar with NVDA.
Level 2 PDF format	Not suitable - she doesn't use Jaws and is not familiar with NVDA.
PDF with Audio Form Fields format	OK, but she had difficulty keeping track of where she was in the exercise. She would need practice to become confident and secure.
iOS	OK, but she was new to VoiceOver and again had difficulty knowing where she was in the file.

Learner 5	R, S5. Uses Jaws 13, also has a MacBook with VoiceOver. R prefers the Mac for accessing some web sites: Jaws is no good with combo (answer) boxes, better on a Mac. Staff modify papers by saving them from PDF to Word so that R can access them with Word.
Date of interview	9/3/15
Word format	R prefers using Word with Jaws on the computer. He tried the protected version but was not able to get out of the edit text mode.
Level 2 PDF format	Same problem as above – he could not get out of text edit mode and so could not swap between reading the question and answering it in the form field.
PDF with Audio Form Fields format	R was not sure whether he liked the format or not - because he was not familiar with it.
iOS	Not relevant - R uses Windows and Macs.

Learner 6	Z, S3.
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	<p>Requires 48pt or larger. In first and 2nd year, Z used a laptop with the WordTalk or MiniReader text readers. Staff practice was to select text for Z and read it out with MiniReader. Z has been learning to touch type and has made quite a lot of progress. She uses WordTalk to echo the keys back as she types.</p> <p>Last year, the school raised funds and purchased an iPad for Z. They have briefly explored VoiceOver but Z cannot use it independently to any great extent.</p>
Date of interview	19/6/15
Word format	Not tested.
Level 2 PDF format	Not tested.
PDF with Audio Form Fields format	Not tested.
iOS	Z's preferred option, but she has to learn to use VoiceOver and needs an app that works well with it.

Conclusions from interviews with learners

Format	Conclusions
Word format (unprotected)	<ul style="list-style-type: none">• Learners are generally familiar with reading standard Word files.• Windows screen readers are optimised for Word.• There is a concern that questions could be accidentally deleted.
Word format (protected)	<ul style="list-style-type: none">• Protected Word files avoid the possibility of deleting questions.• They are more difficult to use because candidates must learn how to swap between reading and editing modes.
Level 2 PDF format	<ul style="list-style-type: none">• The Level 2 PDF papers were accessible for learners who were skilled at using the screen reader.• Again, to access Question and Answer papers, candidates must learn to navigate between the reading mode to access the questions, and the edit mode to type their answers.
PDF with Audio Form Fields format	<ul style="list-style-type: none">• Learners felt that the format was very simple to use, but not sufficiently flexible.• The technique cannot be used for standard classroom resources or to access the internet, so adopting this format would result in a resource implication for SQA and schools.
iOS	<ul style="list-style-type: none">• 5 out of the 6 learners use iOS devices and felt that papers should be available on iPads.

Survey on Access to Curriculum Resources for Learners with Visual Impairment

The research so far had indicated that learners with visual impairment were increasingly using iPads in schools to access the curriculum, and there were suggestions from some staff and learners that the iPad with VoiceOver was more functional than Windows-based screen readers. Therefore, there was a need to investigate whether iPads were in fact being used by learners with visual impairment in Scotland.

We designed a survey (Appendix 2: Access to Curriculum Resources Survey Form) which was distributed to members of SAVIE (Scottish Association of Visual Impairment Educators) on 18/3/16.

The survey asked staff to indicate, for individual learners, which type of technology was being used to access the curriculum, the file formats used, the techniques employed to increase the size of text and images, audible methods of support including text-to-speech and screen readers, and whether tactile formats such as Braille were used.

The survey was distributed as A3 paper; as a Microsoft Word form; and as a PDF form with answer boxes. Responses were received in respect of 325 learners in 17 local authorities.

Digital Devices in use

Of the 325 learners, 292 (90%) were identified as using a computer, tablet or both. Table 2 gives the number of learners using different types of devices.

47% of the 292 learners use a Windows laptop, followed by 25% who use an iPad and 8% use a Windows desktop. Kindles, BrailleNotes and Windows tablets are less commonly used. Only one learner is using a Chromebook.

Table 2: Number of learners using computers or tablets

Device(s)	Number of learners	Device(s)	Number of learners
Windows laptop	196	Refuses Assistance	2
iPad	105	AlphaSmart	1
Windows desktop	33	CCTV	1
iPad, Kindle	12	iPad - iPad Pro to be trialled	1
Kindle	12	iPad & Beanz Snoog	1
iPad, Bluetooth keyboard	9	iPad shared in nursery for game apps	1
BrailleNote	5	iPad, Kindle, Bluetooth keyboard	1
Windows tablet	5	iPad. About to introduce iPad into school in classes.	1
Windows, iPad	5	Kindle, AlphaSmart	1
Classroom Camera	3	Large Promethean Board	1
iPad Pro	3	Phone home use for reading	1
iPad, Large class interactive board	3	Windows, iPad (home only)	1
Android	2	Windows, iPad, Android	1
Bluetooth keyboard	2	Windows, MacOS	1
Large Board	2	Windows, MacOS, Chromebook	1
MacOS	2		

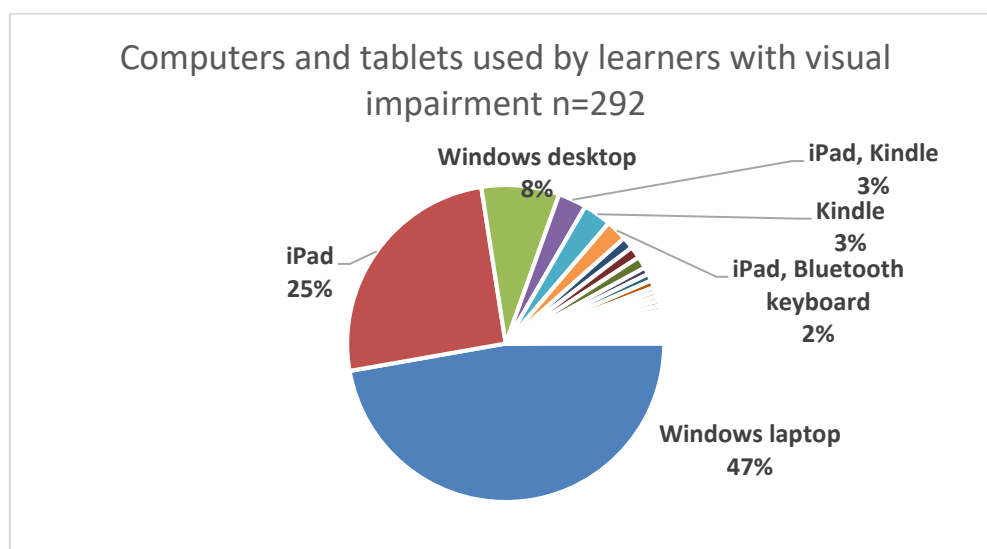


Figure 12: Breakdown of devices used by learners

If we aggregate the number of learners using the three most popular types of device, we find that 205 (63%) out of the total 325 learners are reported to use Windows laptops, 144 (44%) use iPads, and 33 (10%) use a Windows desktop computer.

Many learners use more than one device, hence, for example the learner who uses a Chromebook also uses a Windows and a MacOS laptop.

Braille devices

37 (11%) learners out of 325 are reported to be using a Braille device (Table 3).

Table 3: Number of learners using a Braille device

Braille device	Number of learners
Manual Braille	13
Electronic Braille, Brailnote	6
Manual Braille, Electronic Braille	3
Braille display, Notetaker	3
Manual Braille, Notetaker	3
Manual, Electronic Braille, Display Braille, Notetaker	2
Manual Braille, Will progress to BrailleNote	2
Manual Braille, Display Braille, Notetaker	1
Manual Braille, Notetaker, BrailleNote	1
Notetaker	1
Manual Braille, Braille Display	1
Manual Braille, Notetaker, BrailleNote	1

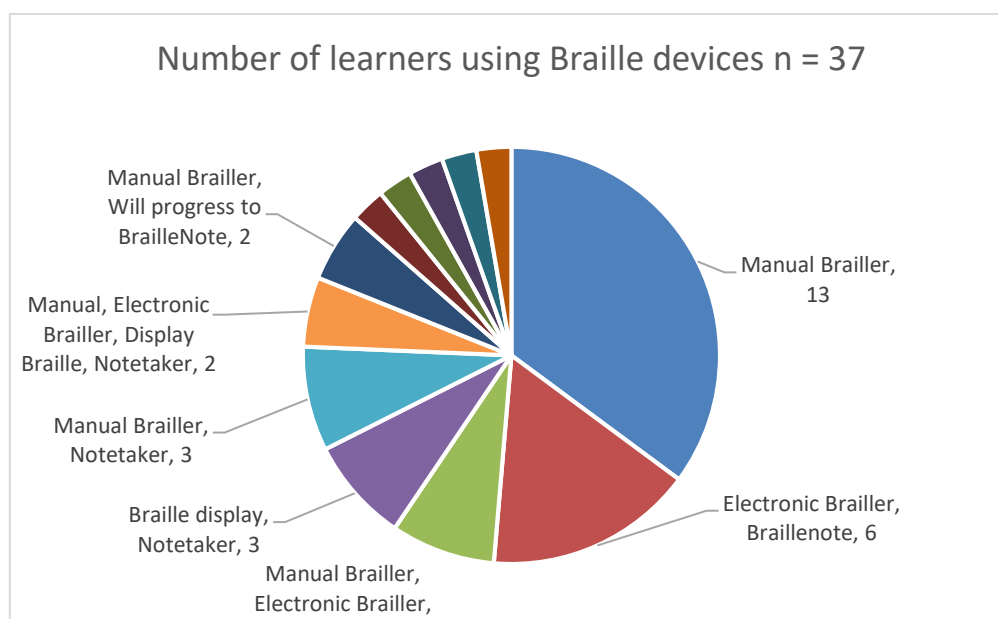


Figure 13: Learners using Braille devices

Manual Brailers are most common: 13 learners are using manual Brailers only, plus another 14 who use a manual Brailer along with another type of device. Digital Braille Notetakers such as the Brailnote are used by 18 learners.

Again, use of Braille devices is not exclusive – most of the learners identified as using Braille devices also use Windows laptops and iPads.

File formats

Respondents were asked to indicate which digital file formats are being used by learners on their devices: this is a particularly important question for this investigation. Information on digital file formats was received in respect of 207 out of 325 learners.

Table 4: Number of learners using different digital file format

File Format	Number of learners
Word	79
PDF, Word	59
Large print PDF, Word	38
PDF	10
Large print PDF	7
PDF, Large Print PDF	4
PDF, Large Print PDF, Word	3
Word, Plain Text	2
Braille	2
PDF, Word, Plain Text	1
Plain Text	1
Word, Clicker 6	1

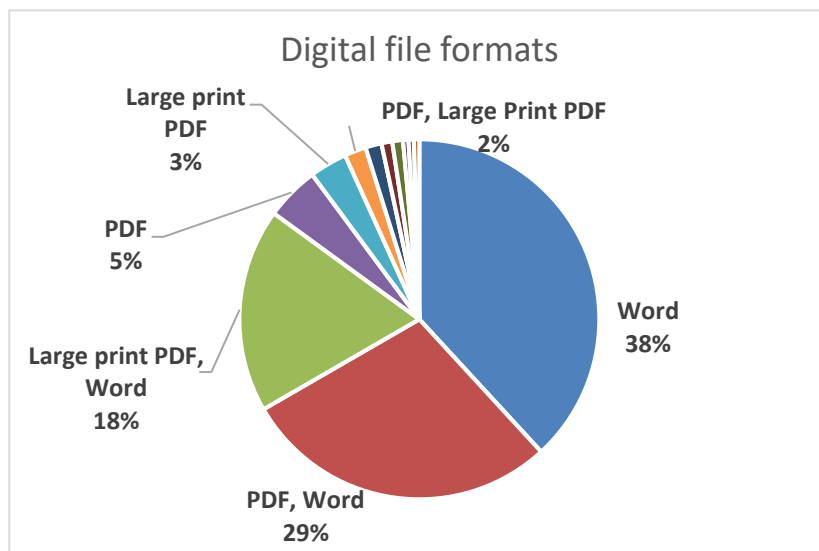


Figure 14: Digital File Formats

Table 4 and Figure 14 show that 38% of the 207 learners use files in Microsoft Word format, 29% use both standard PDF and Word, and 18% use Large Print PDF and Word. If we aggregate together the number of learners that are using each type of format, we find that Word is most common – 183 learners use Word; followed by 70 who use standard and 52 who use Large Print PDF (Table 5). This probably reflects the relative popularity of file formats of digital curriculum materials in schools in general.

Table 5: Aggregated number of learners using each file format

File Format	Aggregated number of learners using the format
Word	183
Standard PDF	70
Large Print PDF	52
Plain Text	4
Braille	2
Clicker 6	1

The finding that Large Print PDF is used by 52 learners is of interest. PDFs do not ‘reflow’ on iPads to fit the screen, and so some services produce PDFs with a larger font so that learners do not have to zoom and swipe around the screen. The survey did not offer options for respondents to select ‘eBook’ or ‘HTML’, but it is likely that learners are using iBooks on iPad, for example, and we know from the ‘device’ responses that 26 learners are reported to be using Kindles.

Computer Readers

68 learners (21%) out of 325 are reported to use computer readers – either a screen reader or a text reader. VoiceOver on the iPad is the most common text-to-speech technology and is used by 35 learners. (Table 6 and Figure 15). This finding is particularly relevant and confirms the information from learners and staff in the first two phases of this project.

VoiceOver on iPad is the most popular screen reading technology and so digital papers for this group of candidates must be accessible to candidates using VoiceOver on iPad as well as screen reader technologies on Windows computers.

Jaws is the most common reported Windows screen reader, followed by Read&Write Gold 10. The eleven learners who use this software are all located in Aberdeenshire, which has an authority wide licence for the software. Packages like Jaws and SuperNova tend to be purchased and installed for individual learners.

The built-in Windows Narrator screen reader is not reported as being used by learners. This may or may not reflect practice - Narrator was not offered as an option in the survey (because in our experience it is not often used) and while there was an opportunity to respond with 'Other', no respondents reported use of Narrator.

Table 6: Computer Text or Screen Readers

Computer Text and Screen Readers	Number of learners
iPad VoiceOver	31
Jaws	12
Read&Write Gold 10	11
Supernova	2
Dragon	2
iPad Speak Selection	2
Jaws, iPad VoiceOver	2
Jaws, SuperNova, iPad VoiceOver	1
Chromebook	1
WordTalk	1
Mac VoiceOver, Talking Tunes	1
iPad VoiceOver, Zoomtext	1
Switches	1

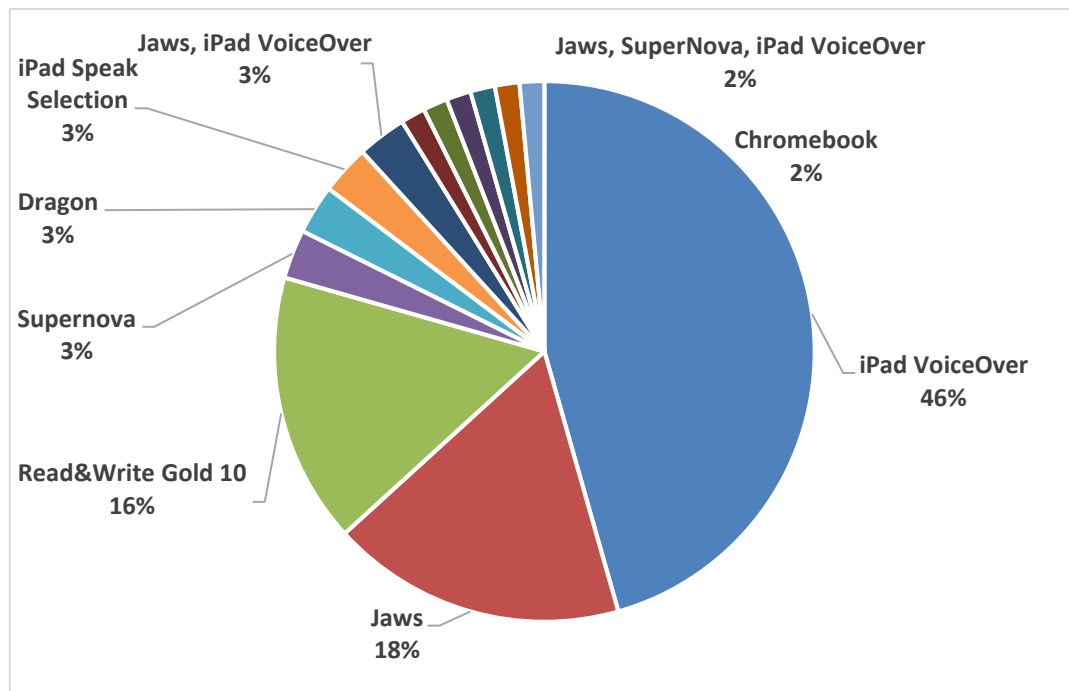


Figure 15: Breakdown of Computer Readers, n = 68

Audio books

Respondents were asked to report on use of audio books, and Table 7 shows that 94 out of 325 learners (29%) use audio books. Audio books are of course delivered in many different formats and accessed using a range of different devices – on CD, on USB stick, as well as digital download on Windows and iPad.

It is interesting that only 9 learners are reported to use DAISY audio books. The DAISY (Digital Accessible Information System; DAISY, 2017) format was developed specifically for people with print disabilities and heavily promoted for many years, but this research suggests that it has yet to make a significant impact for learners in Scotland.

Table 7: Number of learners using audio books

Type of audio book	Number of learners
Audio books	82
Audio and Daisy books	5
Daisy Books	4
Audio on Kindle	2
Books4All, Seeing Ear downloads, VoiceOver iPad and Zoomtext	1

Human Readers

The main purpose in undertaking the survey was to research which screen reading technologies are being used by learners with significant visual impairment.

However, we also asked respondents to indicate how learners were being supported by staff to access the curriculum: 98 (30%) of learners are reported to use human readers, while 41 (13%) use scribes.

Table 8: Staff readers and scribes

Staff support	Number of learners
Reader	55
Reader, scribe	37
Reader - If required	4
Scribe	4
Reader. For literacy difficulties, not visual.	2

Screen Magnification Software

172 learners (53%) of learners are reported to use some sort of screen magnification software or facility. The most common are the tools built in to Windows and iPads as standard (Table 9). Of the specialist tools, SuperNova is more popular than ZoomText. Note that many learners use the tools on several devices – for example, 29 learners use screen magnification on both Windows and iPad machines.

Table 9: Screen Magnification Software

Screen Magnification software	Number of learners
Windows built in	74
Windows built in, iPad built-in	29
iPad built-in	24
Accessible options on PC	11
SuperNova, iPad built-in	9
VI settings on network	7
Windows built in, Zoomtext	2
SuperNova	2
MacOS built-in, iPad built-in	2
Zoomtext, iPad built-in	2
Windows built-in, iPad built-in	1
Windows built in, SuperNova	1
Windows built in, iPad built-in, Accessible options on PC	1
Zoomtext	1
iPad built-in, VI settings on Schl. Computer	1
iPad built-in, Prodigy Tablet	1
GHOTIT	1
iPad built-in, Accessible Options on PC	1
iPad built-in, Chromebook built-in	1
Android built in on PC	1

Magnifiers

154 learners (47%) out of 325 are reported to use a magnifier, most commonly a hand-held device (Table 10). Despite the uptake of technologies, it is clear that traditional 'low tech' aids still have a valuable role to play in the classroom.

Table 10: Magnifiers

Magnifier	Number of learners
Hand held magnifier	91
Hand held magnifier, Desktop magnifier	19
Desktop magnifier	11
Hand-held Magnifier	8
Electronic magnifier	5
Hand held magnifier, Electronic Magnifier	4
Hand held magnifier, electronic magnifier, desktop magnifier	3
Hand held, Electronic & Desktop magnifiers	2
Electronic magnifier, desktop magnifier	2
Hand held magnifier, Telescope	2
Hand-held Magnifier, Electronic magnifier	1
Monocular, Prodigy, Connect 12	1
Monocular	1
Prodigi, Connect 12	1
Hand held magnifier. Normal near vision but sometimes crowding difficulties - magnifier used to help.	1
Hand held magnifier. Font size normal - CVI - some crowding difficulties - magnifier helpful for Geography	1
Hand held magnifier. Desktop magnifier.	1

Appendix 1: Sample Comprehension Exercise used for interviews with learners

Eating a Balanced diet.

No single food is good or bad for us. The important thing is the balance of the diet as a whole. One way to ensure that we eat a balanced diet, one that contains all nutrients in the correct amount is to eat a wide variety of foodstuffs.

The Eat Well Plate.

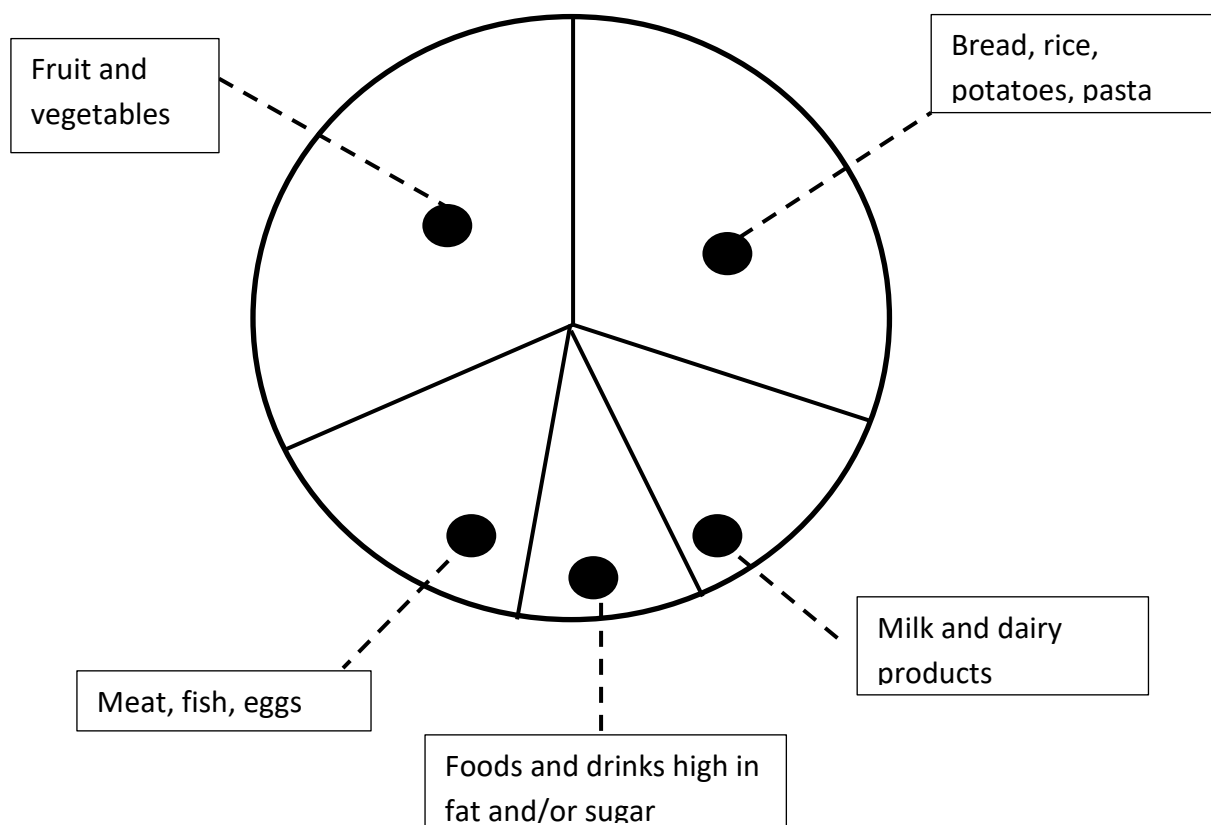


Image description.

The Eat Well Plate. The Eat Well Plate has one third with fruit and vegetables; one third with bread, rice, potatoes or pasta; and the remaining third made of equally of meat, fish or eggs, fatty or sugary foods, and milk and dairy products.

Choosing foods from the food groups in the approximate proportions shown and choosing different foods from within each group helps to ensure that all the essential nutrients are consumed in adequate amounts. People need different amounts of energy therefore require different amounts of food but the proportion of foods from the different groups should be the same.

This balance does not need to apply to every meal but used for your overall eating plan.

Question 1.

Which foods should make up the main part of each meal?

Cooking.

1. Always wash hands at the beginning of a lesson, before touching food and especially after visiting the toilet. Use hot water liquid soap and dry hands thoroughly.
2. Tie long hair back and do not let it hang down over food when preparing it.
3. Always wear a clean apron when preparing food.
4. Keep nails clean and short.
5. Do not wear nail varnish.
6. Cover cuts with a blue plaster.
7. Do not cough or sneeze over food

Question 2.

Give 3 examples of good personal hygiene in the kitchen.

Question 3.

What can you do in a kitchen to keep flies away?

Question 4.

Why should you not lick your fingers when cooking?

Microwaves.

Reheated food in a microwave should be stirred halfway through the heating and given the correct standing time to avoid cold spots.

Question 5.

Explain how you would reheat food in a microwave.

Appendix 2: Access to Curriculum Resources Survey Form

Name _____ Service _____ Local Authority _____

The aim of this survey is to get a snapshot of the formats, technologies and methods that are currently used by learners with visual impairment in Scotland to access curriculum materials in school.

Please tick all the formats and technologies that are used by each learner.

		TECHNOLOGY			VISUAL			AUDIO			TACTILE	
Learner (initials or other ID)	Age	Laptop Windows <input type="checkbox"/> MacOS <input type="checkbox"/> Chrome book <input type="checkbox"/>	Tablet Windows <input type="checkbox"/> iPad <input type="checkbox"/> Android <input type="checkbox"/> Kindle <input type="checkbox"/> Bluetooth keyboard <input type="checkbox"/> Other: _____	File formats PDF <input type="checkbox"/> Large Print PDF <input type="checkbox"/> Font _____ Font size _____ Word <input type="checkbox"/> Plain Text <input type="checkbox"/> Other: _____	Large Print (paper) Font _____ Font size _____	Screen Magnification Windows built-in <input type="checkbox"/> Zoomtext <input type="checkbox"/> SuperNova <input type="checkbox"/> MacOS built-in <input type="checkbox"/> iPad built-in <input type="checkbox"/> Chrome book built-in <input type="checkbox"/> Other: _____	Magnifier Hand-held magnifier <input type="checkbox"/> Electronic magnifier <input type="checkbox"/> Desktop magnifier <input type="checkbox"/> Other: _____	Human Reader <input type="checkbox"/> Scribe <input type="checkbox"/>	Text-to-speech Jaws <input type="checkbox"/> NVDA <input type="checkbox"/> Supernova <input type="checkbox"/> Mac VoiceOver <input type="checkbox"/> iPad VoiceOver <input type="checkbox"/> Other: _____	Audio Books Audio books <input type="checkbox"/> Daisy Books <input type="checkbox"/> Other: _____	Braille Grade 1 <input type="checkbox"/> Grade 2 <input type="checkbox"/> Moon <input type="checkbox"/>	Braille device Manual Brailer <input type="checkbox"/> Electronic Brailer <input type="checkbox"/> Refreshable Braille Display <input type="checkbox"/> Braille Notetaker <input type="checkbox"/> Other: _____
Learner (initials or other ID)	Age	Laptop Windows <input type="checkbox"/> MacOS <input type="checkbox"/> Chrome book <input type="checkbox"/>	Tablet Windows <input type="checkbox"/> iPad <input type="checkbox"/> Android <input type="checkbox"/> Kindle <input type="checkbox"/> Bluetooth keyboard <input type="checkbox"/> Other: _____	File formats PDF <input type="checkbox"/> Large Print PDF <input type="checkbox"/> Font _____ Font size _____ Word <input type="checkbox"/> Plain Text <input type="checkbox"/> Other: _____	Large Print (paper) Font _____ Font size _____	Screen Magnification Windows built-in <input type="checkbox"/> Zoomtext <input type="checkbox"/> SuperNova <input type="checkbox"/> MacOS built-in <input type="checkbox"/> iPad built-in <input type="checkbox"/> Chrome book built-in <input type="checkbox"/> Other: _____	Magnifier Hand-held magnifier <input type="checkbox"/> Electronic magnifier <input type="checkbox"/> Desktop magnifier <input type="checkbox"/> Other: _____	Human Reader <input type="checkbox"/> Scribe <input type="checkbox"/>	Text-to-speech Jaws <input type="checkbox"/> NVDA <input type="checkbox"/> Supernova <input type="checkbox"/> Mac VoiceOver <input type="checkbox"/> iPad VoiceOver <input type="checkbox"/> Other: _____	Audio Books Audio books <input type="checkbox"/> Daisy Books <input type="checkbox"/> Other: _____	Braille Grade 1 <input type="checkbox"/> Grade 2 <input type="checkbox"/> Moon <input type="checkbox"/>	Braille device Manual Brailer <input type="checkbox"/> Electronic Brailer <input type="checkbox"/> Refreshable Braille Display <input type="checkbox"/> Braille Notetaker <input type="checkbox"/> Other: _____

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CALL Scotland
The University of Edinburgh
The Moray House School of Education
Paterson's Land, Holyrood Road
Edinburgh
EH8 8AQ
<http://www.callscotland.org.uk>
www.AdaptedDigitalExams.org.uk